Bachelor Thesis
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Analysis and simplification of architectural floor plans

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0.1   Abstract

This work's main topic is the analysation of floor plans to detect and mark areas where different types of floor heatings will be installed. The idea is to automate this process for simple floor plans and provide additional tools to correct possible errors in more complicated plans.

This work will be split into sever parts. The first part will describe several algorithms used for preprocessing the image to remove any noise. Additionally, the algorithms for room detection and object detection will be explained.

The second part will contain the whole project management and implementation. This includes for example a timetable of our work, the class structure and much more information concerning the project setup and execution.

Last but not least, we will present and dicuss the results of our work. This also includes features that may be built in the future and the limitations of our work.

0.2 Introduction

0.2.1 Starting position

The company PlanFabrik GmbH creates floor plans for house technology. In a first step the plans are analysed and enhanced through an employee. He adds more information to the plan, like room polygons or he marks areas where house technology can be installed and where not. Those areas are defined by different features. For example, usually the area close to windows has a higher density of pipes emitting heat to the room. This is to equal out the heat loss that usually occurs on windows.

The process of drawing those areas is currently tool supported but still takes a lot of time, equal to the rising amount of rooms the employee has to analyse. The idea is to create a more automated system which does require only a small amount of user input.

0.2.2 Problem description

To manually create all the room-areas, it takes the user a lot of time. This is due to the fact that he has to click every corner of each room to make the room-enclosing polygon. The fact that the current tool is not too precise, which means that errors in selecting the exact corner exist regularly. The user then has to rearrange the created corner to fit the exact corner in the image. This process of selecting all the corners by hand is highly ineffective, especially for floor plans that have several hundred or even thousands of corners in it.

An automated solution would provide a faster and more comfortable solution for the client. Additionally, the software may provide additional info that is needed. It can calculate the size of each room directly, which would otherwise have to be calculated by hand.

0.2.3 Goals

The idea of theory of this bachelor thesis is to compare different algorithms which can automatically analyse floor plans and draw the polygons for the rooms. The goal in the end is to show and explain a way to solve the problem and decide which algorithms are used best. All of this will help us create a software that can do the automated analysis for basic floor plans. More complicated floor plans may hold problems that our algorithms can not find, those are supposed to be solved manually with an editor. In the end, the program is supposed to create an output-file with the information of the areas found which is exportable to the existing software that currently handles the following processes.

0.3 Theory

0.3.1 Preprocessing

Erosion and Dilation

Distance transformation

0.3.2 Object detection

Orientated FAST and Rotated BRIEF

Cascade training

0.3.3 Room detection

Hough transformation

Watershed

The watershed-algorithm in our project is used for segmentation of the different rooms. It can find rooms indifferent of its shape.

The algorithm is processed on a grayscale image on which the color intensity is analogous to the height in a heightmap. The watershed in use does flooding. The idea is to place a water source in each regional minimum and flood the entire relief. It will stop if it meets a different watersource or an impassable barrier.

0.4   Implementation

0.4.1   Software Architecture

User Interface

Algorithm

Workflow

0.4.2   Analyse

Noise Removal

Room Detection

Object Detection

0.5 Result

0.6   Conclusion